RTN GPS Update January 31, 2007

Washington Spatial Reference Network expands

The Washington Spatial Reference Network (WSRN) has expanded considerably during the last six months (see attached map). There are now 50 of the planned 80 stations providing data to the network, of which 43 are included in the network solution. Currently these stations are divided into four separate sub-networks designed to provide VRS solutions. These sub-networks can be defined as the Puget Sound, NE-Spokane area, SE- TriCities area, and SW-Vancouver/Portland area. The network has expanded beyond Washington boarders to include stations in British Columbia, Oregon, and Idaho insuring complete coverage up to our state perimeters.

Special thanks must go to Gavin Schrock of Seattle Public Utilities for the many road trips pursuing infrastructure sites and contacts while working out detailed communication issues. Washington is the only state in the nation to construct a Real-time GPS network as a cooperative. While we are possibly the marvel of the world to do so, the additional effort involved in partnerships is extremely strenuous. Never the less, the desire to acquire the efficiency RTN GPS offers, has produced the type of public and private involvement needed to get us to this stage.

With the increased utilization of the WSRN system comes the need for training and education. The subject of transforming GPS-derived coordinates to a local coordinate system such as the Washington State Plane Coordinate System or a Project Datum derivative, has become a highlighted need at WSDOT. The process known as "calibration or transformation" is essential to accuracy and compatibility of the RTN system output. The WSRN coordinate output are defined as NAD83CORS (Constant Operating Reference Stations), which can differ from NAD83/91 by amounts up to 0.3 tenths of a foot (see attachments). The process is set to become part of the 2007 WSDOT Survey Camp instruction.

Another area in need of education is related to datum, datum adjustments, and network adjustments. While most of our state's civil work involves the NAD83 datum, the upgrade from 1991 adjustment to 2007 will add another component to consider when making survey decisions for a project. Geographic Services has conducted a statewide resurvey and adjustment effort during the 05-07 biennium to combine former "project-based" primary control to a true "statewide primary network", that will enable a comprehensive and more accurate upgrade to the national NAD83/2007 upgrade. In addition to increased accuracy in the current NAD83/91 offering, these new coordinate values will be made available on the WSDOT Monument Database.

In addition to the national datum adjustment upgrade, some RTN base station positions may see annual change due to tectonic drift. This unfortunate fact of life

is primarily because WSRN coordinates are derived from a rigorous adjustment utilizing the National CORS network ,maintained by the National Geodetic Survey. These annual adjustments are necessary for system accuracy and compatibility. Because WSDOT projects are ongoing, over the period of many years, proper calibration/transformation techniques and documentation as related to the project geometric framework will be critical when using this efficient system. This issue is also set to become part of the 2007 WSDOT Survey Camp instruction.

Olympic Region contributing to WSRN

Planning is set to begin soon on expansion of the WSRN throughout WSDOT's Olympic Region. Past efforts of Joe Davis, Steve Palmen, Nathan Jacobs, and Kurt Iverson resulted in obtaining support from Pasco Bakotich, Olympic Region Project Development Engineer. Pasco quickly realized the benefits of WSRN in his Region and decided to support a "full coverage" approach. First order of business will be coordinating with Thurston County to get the previously-installed deep drilled PANGA mount fitted with a receiver, antenna, and communications at Grand Mound. In addition, PBO has agreed to provide WSDOT a RTN feed from its site in Elma (all that is needed is communications). When combined with an installation at the Lake Cushman Dam, west of Hood Canal, a majority of the east half of the Region will be covered and a major connection to John Thomas' SW Region sub-network efforts made ready. Ten stations are slated to come on line with this effort, including stations along the coast connecting to Port Angeles.

Geographic Services forms partnership with ITS Office

A partnership between Geo's Survey Section and the Intelligent Transportation System (ITS) Communication and Wireless Office has resulted in the creation of a "Electronic Design Engineer" position dedicated to RTN development. This position evolved from the RTN Coordinator, originally slated to provide coordination to implement RTN infrastructure. Due to the rapid growth of the base station infrastructure across the state and the ever increasing problem of resolving communication issues, the decision to involve the ITS Office seemed logical. The need for RTN communication development comes at a time when other entities internal to WSDOT (such as TDO, TEF, Maintenance, and in some cases, other state agencies) are in great need of similar wireless data transfers. WSDOT needs will be evaluated as a whole. Although the need for coordinating infrastructure development is still of high importance, the ultimate success of the system depends on getting data from the base station to an Internet source (particularly in remote areas) and accessing RTN differential data in areas where cellular is poor or does not exist. In fact, if the corrections can be obtained without total dependency on cellular, the number of uses will greatly expand, creating a greater demand, and further identify sources for funding. Development of a communications infrastructure to support WSDOT's need to provide Real-Time Kinematic data statewide will include the following activities:
Feasibility:

Research rapidly developing communication technologies available to WSDOT and provide advice on how those technologies can be deployed. Provide design alternatives and preliminary budget information to stakeholders.
Design:
Provide system design for fixed base station and rover RTK communications, generated from stakeholder decisions and utilize cost effective methods while considering initial and reoccurring costs. The Design phase will also develop a schedule and implementation plan for both a Pilot Project and statewide implementation.
Pilot Project:
Implement system Pilot Project for fixed base station to Internet capabilities and rover RTK devices. Project goals identified and refined from lessons learned as well as establish performance measurements.
Implementation:
Implement statewide fixed base station and rover RTK device communication system.

- Also involved, is OIT's network expert Randy Baker. Randy will be instrumental in determining network, firewall, and other IT connection solutions. Expect the new ITS Electronic Design Engineer to attend all RTN meetings, seminars, etc in the future pending the March 15th starting date.

Height Modernization Forum

The Spatial Reference Center of Washington (SRCW) will be holding its annual membership business meeting February 8th and outreach seminar on February 9th in Tumwater. Although the "Outreach Seminar" requires registration (because lunch will be provided), it is free. The intended audience is government managers, GIS practitioners, land surveyors, engineers, and location specialists. Presentations include worldwide RTN development, Height Modernization, Washington efforts, structure monitoring, and GPS machine control. See attachment for details.

Spatial Reference Center of Washington pursues Height Modernization

An Interim Progress Report, from the DNR's Spatial Reference Center to the National Geodetic Survey, on Height Modernization activities include the following:

1. Complete a vertical benchmark review of the state and establish where adequate leveling exists and where additional leveling must be performed.
2. Developed a leveling plan using a prioritized regional approach with the goal of measuring 2nd Order, Class 1 orthometric heights for use in future improvement of the geoid in Washington State by the National Geodetic Survey.
3. Performed reconnaissance to evaluate the leveling plan.

4. Catalog all continuous GPS sites and their characteristics in and around the State of Washington.
5. Develop a CORS plan in conjunction with other CORS activities, such as Pacific Northwest Geodetic Array (PANGA), National Differential Global Positioning System (NDGPS), Plate Boundary Observatory (PBO), and the WSRN.
6. Outreach seminars
7. Demonstration leveling projects of 2nd Order, Class 1 with private consultants.
8. Install two new CORS sites.
9. Testing and quality control.

Geographic Services pursues Height Modernization

Geo's Survey Section will be performing two 2nd Order, Class 1 leveling projects to establish orthometric heights on CORS stations. The data for stations located in Grand Mound (a WSRN site) and South Bend (a PBO/National CORS site) will be submitted to the NGS for inclusion into the National Spatial Reference Network. More of these NGS-published projects will get underway next biennium.